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THE  
AGRICULTURAL LEDGER.

1898—No. 4.

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CASTANEA VULGARIS.

(SWEET OR SPANISH CHESTNUT.)

[DICTIONARY OF ECONOMIC PRODUCTS, Vol. II., C. 808-11.]

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THE SPANISH CHESTNUT.

*Note on the Cultivation of the Spanish Chestnut in the Himalayas.*

By SIR E. O. BUCK, KT., C.S.I.

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Other DICTIONARY articles that may be consulted :

Famine Foods, Vol. III., F. 32.

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[ *Dictionary of Economic Products, Vol. II., C. 808-11.* ]

THE SPANISH CHESTNUT.

*Note on the Cultivation of the Spanish Chestnut in the Himálayas.*

By SIR E. C. BUCK, KT., C.B.I.

1. This note will be divided under the following heads:—

I.—The value of chestnuts as a supplementary food-supply in the Himálayas.

II.—The history of past operations in the North-West Provinces and the Panjab.

III.—Cultivation in Spain and Italy.

IV.—Suggestions for future action.

*I.—Value of Chestnut as a Food-supply.*

2. So long ago as 1838 Dr. J. Forbes Royle urged the cultivation of the chestnut in a letter to the Directors of the Honourable East India Company in the following words:—"The common Spanish chestnut," he wrote, "seems well suited to Northern India and the Himálayas, and would yield an additional article of food to the inhabitants of the mountains who are sometimes forced to subsist upon acorns and bitter horse chestnuts."

I.—VALUE  
OF CHESTNUT  
AS A  
FOOD-  
SUPPLY.

C. 808-11.

**CASTANEA  
vulgaris.****The Spanish Chestnut.**

**J.—VALUE  
of CHESTNUT  
AS A  
SUPPLY.**

**Need which  
exists in the  
Himalayas  
for a  
supplemen-  
tary food-  
supply.**

**Wild fruits  
relished by  
hill tribes.**

**Spanish  
Chestnut as  
an additional  
food  
substance  
in Europe.**

3. That the inhabitants of the Himálayas at any material distance from the plains often suffer severely in seasons of deficient outturn is well known. The main reason is the difficulty and cost of importing food-grains from below, especially in years when scarcity is common to the plains and the hills. Perhaps the Kumaonis of the North-West Provinces are better off (in view of their supplementary cultivation in the "Ilhabur" at the foot of the hills and of their general comparative prosperity) than the inhabitants of Native States behind Mussoorie and Simla, but that even they do suffer to a material extent is indicated in the recent "Narrative" published by the North-West Provinces Government on the famine of 1896-97, in which it is remarked that "in the Himálayan districts with a population fast growing in density and harvests entirely dependent on a rainfall, which is not stable, imports of grain have of late years been often necessary to prevent or alleviate distress." A suggestion to construct another railway to the foot of the hills follows. But it may be noted that even when grain has been brought to the foot of the mountain ranges the labour and cost of carrying it over hill-roads into the interior is enormous.

4. It is still the case that in seasons (which as shown above often occur) of local distress the hill-people eat the unpalatable and unwholesome horse chestnut and other wild fruits. Indeed, in many parts of the hills, they partially subsist on wild fruits in every year. In Stewart's report on Bijnor (*page 679, Kumaon Gazetteer*), he remarks that "Hill-men eat greedily all kinds of fruits, both cultivated and wild, and very rarely allow either to ripen thoroughly. The number of wild fruits and berries is very large, and the supply lasts from April to October, forming a welcome, though not perhaps always a healthy, addition to their food."

5. The value of the Spanish chestnut as a supplementary food-supply in tracts where it can be successfully grown has been thoroughly established in the mountainous regions of South-West Europe. The gross annual outturn of chestnut fruit in the hills of Italy is estimated at 360,000 tons (*India Office Reports, 1892, page 35*) or in Indian weight about 10 millions of manads. This quantity at 4 lb a head (see page 9) would feed one million of persons for 100 days without other food. Production in Spain is equally important.

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CASTANEA  
vulgaris.

A large proportion of the nuts are used as food :—

- (1) in the form of flour, for making into cakes (something like the Indian chapatis) either alone or mixed with cereal flours ;
- (2) for making soup ;
- (3) roasted or boiled whole.

It is not the case that the chestnut is preferred as a staple food to cereals. But it is enjoyed as an ordinary article of diet even by the better classes in South Europe and is imported as a delicacy to North Europe, while the lower classes of the mountain countries do actually subsist on it largely. Thus, in the province of Asturias (Spain) (*India Office Reports, 1892, page 25*), it is stated that "in many districts where the crop of grain is poor and uncertain on account of the climate, the chestnut is considered as the basis of the food-supply in its season, which in some localities lasts four months and replaces maize head, beans, and potatoes. (The outturn of nuts in this province is about  $1\frac{1}{2}$  millions of maunds.) In Cuneo (Piedmont) 40 per cent., in Liguria two-thirds, in Piacenza 60 per cent., in Arezzo (Tuscany) two-thirds of the yield is reported to be used locally as food. In these and in other districts the price paid for chestnuts to be exported to other countries is sufficiently large to induce the inhabitants to part with a considerable portion of their crop. But wherever exported it is used, in some form or other, as food.

6. Professor Church in recording his analysis of chestnut flour, intimates that "chestnut flour ought to be of easy digestibility, and a suitable children's food, considering that it contains over 40 per cent. of nutritious matters soluble in pure water." According to Parmentier the nut contains as much nutritive matter as cereals.

7. The facts above noted seem to justify the presumption that the Spanish chestnut will, if it can be successfully and extensively cultivated in the Himalayas, afford a supplementary food-supply of material value to the hill-people even in ordinary years as well as in seasons of scarcity. And it is a satisfactory circumstance indicated by experimental cultivation near Simla that the yield of sound fruit is better in years of light rainfall than in years of abundant rain. This observation is confirmed by the reports from the Continent where the minimum yield is in "cold and rainy seasons." If then

J.—VALUE  
OF CHESTNUT  
AS A  
FOOD-  
SUPPLY.

Cooked in  
various ways.

Appendix II.,  
page 17.

Advantages  
of successful  
cultivation  
in the  
Himalayas.

Yield of fruit  
greatest in  
years of  
light rainfall.  
*Conf., page  
9, para. 2d.*

## *The Agricultural*

### **CASTANEA vulgaris.**

### **The Spanish Chestnut.**

#### **HISTORY OF PAST OPERATIONS**

the chestnut does succeed in the Indian Hills, it will yield its largest supply of food in years when it is most wanted. The reasons why light rainfall is advantageous are given later on.

#### **II.—History of Past Operations.**

8. Experimental cultivation of the chestnut in the Himalayas was for the first time taken up seriously about 25 years ago. An account of the action taken will be found in a report (*Agricultural Ledger No. 15 of 1894*) on Himalayan fruit culture by Mr. Smythies, of the Forest Department. Briefly, it may be stated that the Forest Department after considerable difficulties succeeded in bringing over seeds from Europe in 1873, and three or four years later at the instance of Sir Henry Ramsay and under my own direction, the North-West Provinces Agricultural Department imported after several failures large quantities of sound seed and grafted trees.\* The Forest Department plantations were raised at the Ranikhet fruit garden at an elevation of about 6,000 to 6,400 feet, and those of the Agricultural Department at about 7,000 feet at Muktesar between Naini Tal and Almora. Both gardens were eventually placed under the direction of Mr. Craw, a Scotch tea-planter near Ranikhet, who, having had a training as a professional gardener, was very successful in rearing the trees.

\* Operations  
at Ranikhet.

Muktesar.

Distribution  
of saplings.

Plantations,  
general  
elevation.

9. From both gardens distribution of young trees has been made to the owners of private orchards, to other Divisions of the Forest Department, and to Government gardens, about 2,300 having been sent out from Ranikhet and 600 from Muktesar. Those supplied in the earlier years were grafted trees, but of late years seedlings have been distributed. The point is of importance, since, as will be indicated later on, only grafted trees bear large fruit. The general elevation at which plantations have been formed has been from 5,500 to 7,500 feet. There has on the whole been more failure than success in results. Crops have been small, and a large proportion of the nuts have been hollow shells. The reasons of failure will be discussed presently, but among them the most prominent are that the elevation has been too high, the aspect has often been unfavourable, the number of trees has some-

\* *Note.*—In the event of future importations being required, information as to the most successful method of packing seeds will be found in the Annual Reports of the Forest Department of 1873, *et seq.*

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times been too small to ensure fertilisation, and the rains have occasionally interfered with fecundation at the critical time. That the causes of failure can be removed or considerably modified, is probable. In exceptional cases success has been obtained, and the conditions under which success has occurred can be repeated over large areas available for chestnut plantation, while, on the other hand, conditions of failure can be avoided.

I myself made many experiments at various elevations and aspects near Simla between 1883 and 1895. The most satisfactory results were obtained at Mr. Goad's gardens at 4,500 feet with a north aspect. Baskets of excellent fruit from this garden were often exhibited at the Simla horticultural shows. I found also good fruit at 5,000 to 6,000 feet in private orchards in the Kulu Valley where summer rainfall is light and the land is protected by high mountain walls on either side, though from two gardens the shrivelling of the fruit was reported. Similar results were obtained in the Forest plantations above the Sulej Valley, where again the summer rainfall is light. Here the elevation was from 6,200 to 7,500 feet, the best results being attained at the lowest elevations.

10. There are now in the country a large number of trees, grafted and ungrafted, bearing enough fruit for the unlimited expansion during the next few years of the stock of seedlings, and there are also a sufficient number of grafted trees bearing a fair quantity of sound fruit to admit of the grafting from them of any percentage of seedlings that is wished. The questions that have to be decided, viz., suitable sites for plantations, the best elevation and aspect, the extent to which trees should be grafted, and the varieties of the Spanish chestnut which should be encouraged, will be most conveniently discussed after dealing with the reports which have been obtained from Europe.

**III.—Cultivation in Spain and Italy.**

11. In 1890, I submitted a request to the India Office that information might be obtained from our Consuls in Spain and Italy or from other sources as to the conditions under which chestnuts were grown and utilised as food in those countries. In 1892 the reports\*

\* Copies may be obtained from the Imperial Department of Revenue and Agriculture.

**II.—HISTORY OF PAST OPERATIONS.**

Experiments in Simla neighbourhood.

Kulu Valley.

Sulej Valley.

Abundance of stock.

Location of sites, elevation, aspect, etc.

**III.—CULTIVATION IN SPAIN AND ITALY.**



**CASTANEA  
vulgaris.****The Spanish Chestnut.****III.—CULTI-  
VATION IN  
SPAIN  
AND ITALY.****Catalonia.****Asturias.****Cultivation  
should be  
practised at  
elevations  
below 5,000  
feet.****Products of  
the tree.****Varieties  
(a) for local  
consumption.  
(b) for  
export.**

with a review by Sir George Birdwood were communicated to the Government of India. A summary of the information received is given in the appendices to this note, but a few of the leading and most important facts are detailed in the following section.

12. The following remarks taken from the report received from Catalonia (Reports, page 28), appear applicable to the Himálayas: "Chestnut trees," it is written, "are of very rapid growth in mountain districts which are not generally well adapted for any other sort of culture, and as they require scarcely any care whatever and are certain to yield their annual crop, the increase of their cultivation is easily accounted for."

13. In the report from Asturias (page 25) it is stated that the crop is best in years of warmth and light rainfall. But it is in the report from Catalonia (page 30) that the statement is made which suggests the main reason why so much hollow and shrivelled fruit has been gathered on the Himálayan trees. "Chestnuts," it is said, "blossom in June, and heavy rains in the latter days of June when fecundation takes place may injure them." Now high elevations are in the Himálayas much more exposed to heavy rain in June than low elevations, and if the presumption is correct that for other reasons elevations below 5,000 feet are preferable, it may be found that the percentage of hollow fruit will be much diminished when the trees are grown at the lower levels.

14. The chestnut tree is stated to be grown for the production of—

- (1) Fruit for local consumption as an article of diet.
- (2) Fruit for export.
- (3) Timber.
- (4) Hoops and staves.
- (5) Leaves for manure.

15. The varieties used for local consumption are not, as a rule, those used for export. The large nut, familiarly known as the "Marron," is only "eaten and sold fresh," "the other qualities" which form the larger part of the yield, are ground into flour, etc. (page 18 (Tuscany)). The question arises whether the grafts which we have imported are not too exclusively the "Marron" variety, and if so, the circumstance would perhaps partly account for the difficulty which has been experienced in this country in keeping the

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fruit in good condition, for from all gardens it has been reported that the fruit "spoils" after a few days. The best quality (in Spain) is said to be "a round nut from grafted trees having a separate nut in each shell, nearly spherical," whereas "inferior qualities generally produce three nuts under one cover" (page 23). The Himalayan fruit I have seen either resembles the Marron or the inferior fruit above described—though, perhaps, the latter has been taken from ungrafted trees.

16. Trees grown for fruit are almost always grafted. The fruit from ungrafted trees is in some of the Italian districts only used to feed pigs, but in the report from Catalonia (page 29) the important statement is made that the fruit from ungrafted forest trees, though small and late, is very abundant and by no means inferior in its nourishing qualities to others and is even sweeter. The main reasons why grafted trees are preferred are that the fruit is earlier, of larger size and more readily saleable.

17. The elevation preferred for grafted trees is from 1,500 to 2,000 feet with a northern aspect (pages 17 to 27). An altitude of 3,000 feet hinders perfect development, "as also the accumulation of snow" (page 35). The maximum altitude in North Italy is about 2,500 feet. Extreme dryness is prejudicial, and (in Catalonia) "scarcely a tree is found on the southern slopes, where, probably, the direct action of the sun's rays combines to deprive the soil of whatever moisture it might contain" (page 27). Early or late frost is prejudicial. The soil should be light and sandy.

18. These facts indicate that careful experiments are needed to ascertain the right elevations for grafted trees in different parts of the Himalayas, and confirm the presumption that our plantations have been hitherto placed too high, generally at 5,500 feet and upwards. Trees planted for timber may, however, be successfully grown at somewhat higher elevations, and for coppicing are sometimes "relegated to localities where too low temperatures prevent the fruit from maturing" (page 31). The best temperature for fruit is said to be a medium heat of 55° F., ranging between 14° and 92°, and for timber of 48° F., ranging between 5° and 77° in the shade.

19. The yield of a chestnut tree varies of course with the conditions under which it is grown. The following estimate is given in the report from Asturias (Spain) substituting Indian for Spanish weights.

**IN-CULTI-  
VATION IN  
SPAIN  
and ITALY.**

**The best  
fruit  
described.**

**Difference  
between  
fruit from  
grafted and  
ungrafted  
trees.**

**Best  
elevation for  
grafted  
trees.**

**The tree  
thrives in a  
moist but  
light and  
sandy soil.**

**Further  
experiments  
necessary.**

**Suggestions.**

**Yield in  
Europe.**

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vulgaris****The Spanish Chestnut.****II.—CULTIVATION IN  
INDIA  
AND ITALY.**

About 32 trees are planted in an acre. The produce of a tree is about 10 seers and the produce of an acre about 8 maunds. But this estimate assumes the youngest trees to be 12 to 15 years old and the oldest "several centuries" (page 24). Another estimate from Catalonia gives the produce of a tree over 25 years in full bearing as three-fourths of a maund (page 31), while from Tuscany the average yield in seven years from about a million of acres is given as between 7 and 8 millions of maunds (page 17). (This nearly agrees with the Asturias estimate.)

**V.—SUGGESTIONS  
FOR  
FURTHER  
ACTION.****IV.—Suggestions for Further Action.****Experimental  
plantations.**

20. The distribution of trees in small quantities to isolated gardens or cultivators' holdings is not, at present, an important object. It would seem desirable for the next few years to make experimental plantations under expert direction at different elevations and in different localities, in order to ascertain positively what are the most suitable conditions of soil, elevation, and climate for the successful cultivation of the tree in the Himalayas. The plantation should be large in order to give every facility for fertilization, as there is reason to believe that where only a few trees are in one neighbourhood pollen is not carried from one tree to another in sufficient quantities.

**Also  
important  
for  
fertilization.**

21. Such experiments could perhaps be most usefully carried out by the Forest Department. In view of the fact that chestnut timber is valuable there need not, as I have been told by a Forest officer (Mr. Hearle, Deputy Conservator, Naini Tal), be any loss, even if the fruit turns out to be of no great importance. In some cases, however, it may be hoped that the fruit itself will, when the trees have arrived at maturity, 20 or 30 years hence, be of material value as a food for the neighbourhood.

**Value of  
timber stated  
to recoup  
for small  
yield of  
fruit.****Seedlings  
available.**

22. There are now some 3,000 seedlings at the Ranikhet garden which could, some grafted and some ungrafted, be thus utilised. In making grafts the older trees which are found to bear single kernels and compact nuts (most in accordance with the description of paragraph 15) should, perhaps, be chosen to supply graft wood. There are probably other seedlings available at the Simla gardens or in the forests beyond Simla which could be similarly utilised.

23. Considerable quantities of seed from the older trees planted 20 to 25 years ago are now annually available. If the Forest Department

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ment would permit the seed to be sown in nurseries every year large stocks could be annually raised. In consideration, however, of the doubt which exists whether we have imported into India grafted trees of the kind which are explained in paragraph 15 to be the most useful for food purposes, it might be desirable to obtain, through the India Office or otherwise, a few more grafted plants in Wardian cases from Spain. Otherwise there is plenty of material to work with.

24. The evidence from Europe and in India itself points to the desirability of planting between 3,000 and 5,000 feet rather than as hitherto between 5,000 and 7,000 feet. The best elevation can only be ascertained by careful experiment and may differ in different parts of the Himálayas. There seems, however, to be no doubt as to aspect. It must be north rather than south, and north-east rather than north-west. Localities of heavy rain should be avoided. If, as seems probable, an elevation of 4,000 feet is not unsuitable, the lowness of altitude will in itself ensure a lighter rain than that which occurs at higher altitudes, especially as the earlier rains are believed to be heavier on southern than northern slopes. As already indicated, heavy rain in June interferes with fecundation, but much wet later on seems also to have a tendency to rot the ripening fruit. It is, perhaps, for these two reasons that years of scanty rain appear to result in better crops of fruit. If the correctness of this presumption can be established, the circumstance is in favour of the belief that the fruit will be a valuable food-supply in years of comparative drought and scarcity. These arguments do not, however, much affect experiments in those regions of the hills, such as Kulu and Kashmir, which are beyond the influence of heavy summer rain.

25. It would seem desirable that, in order to ascertain with more certainty what is the actual effect of differing elevations and rainfalls on the fertility of chestnut trees in the Himálayas, registers should be kept of the average weight and condition of the crop of various plantations. Some information of the kind might also be annually obtained from planters who have a sufficient number of chestnut trees in their orchards to give value to the observations.

26. It is possible that the best land which could be taken up for chestnuts would be the belts which lie just at the foot of large forests and just above the gentler slopes of cultivation including perhaps a few fields. Only such fields would be used as are seldom cropped or

V. - **STANDARD**  
**FOOD**  
**ACTION.**See  
Appendix I.Elevation  
required for  
successful  
growth.

Aspect.

Avoid heavy  
rainfall.Conf., page  
3, para. 7.Registers of  
weight and  
condition of  
crop  
recom-  
mended.Appendix I,  
page 10.

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**IV.—STAGES  
FROM THE  
ACTION.  
Leaves  
allured  
mature.**

**Concluding  
Remarks.**

are too steep for really successful cereal agriculture. The fact that the leaves give a useful manure is also in favour of plantations near cultivated land.

27. It would seem to be premature to press the cultivation of the tree at present on the agricultural population, although exception might be made in the case of intelligent proprietors with large estates or holdings, especially in those instances where they already have formed orchards of fruit trees. But attention may be drawn to the circumstance that a Pictorial Lesson Sheet on the chestnut tree and its uses was some time ago prepared (in the Imperial Office of Revenue and Agriculture), which might, with such additions as may be considered necessary, be utilised in Himálayan schools, translated, if wished, into hill dialects. Familiarity with the fact that the chestnut can be used in various ways as food may prove to be of eventual service.

**APPENDIX I.****APPENDIX I.*****Synopsis of Reports from Italy and Spain.***

The headings adopted below are mainly taken from an account of the chestnut tree included in his "Manual of Forestry" by Dr. Sohlich, formerly Inspector General of Forests and now Professor of Forestry at Cooper's Hill. The reports referred to are contained in Sir George Birdwood's pamphlet. The various methods of preparing the fruit for food are summarised in Appendix II. The utility of the chestnut for food is not referred to in Appendix I.

**Sohlich.**

*Utility.*—Yields a fairly hard, moderately heavy timber, specific gravity air dried =.66; splits well; durable; used for building; in carpentry staves for wine casks, line stakes, hop poles. Not a very good firewood but charcoal. Much appreciated by blacksmiths. Bark used for tanning.

**Asturias  
(Spain).**

Timber for building; leaves to enrich soil; wild mountain species gives better wood.

**Catalonia  
(Spain).**

Trees cut down (coppiced) throw out branches 20 to 30 feet high in four or five years, diameter at foot 2 to 4 inches; cut into two or more strips for hoops of casks. For staves only three or four branches allowed to grow for 20 to 25 years. Compete favourably with American oak staves. For timber only one trunk. Excellent timber; neither warps nor rots; resists dampness perfectly; does not

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admk of fine polish. Saw-dust and refuse profitably distilled containing abundant tar and other utilisable substances.

**Elevation and Aspect.**—A tree of the lower hills and mountains preferring northern and eastern aspects.

400 to 800 metres.

Does not generally flourish above 1,000 metres.

Chestnuts lie between cultivated land and oak forests.

Only on northern slopes where cool breezes, springs and rivulets prevail; at 2,000 to 3,000 feet.

Not higher than 800 metres; in valleys.

**Climate.**—Mild. Tree is tender against early and late frost; light demanding but less than oak; stands shade in youth and thrives under Scotch pine. Storm firm.

Require damp atmosphere; renovated by cool moist currents of air. Excessive dampness of ground injurious. Low temperature tends to promote vertical growth at expense of fruit, but great cold makes them stunted.

**Soil.**—Likes a deep, porous, fresh and fertile soil. Can grow in rather dry soil if deep, but avoids wet. Loamy sand suits it best; does not like heavy or calcareous soils.

Sandy, light and porous. Clayey, stoney and compact grounds unfit; on slatey formations not a single tree is found. Not very exacting as to chemical conditions of soil. Development depends infinitely more on situation, hydrometric state of atmosphere, temperature, and physical conditions of soil. Soil in Catalonia is detritus of adjoining granite rocks, so loose and incoherent that it falls in separate grains; generally composed of silex orthose, felspar and mica.

**Shape and Development.**—Straight stem branching at moderate height. Root system deep growing like oak. Lower than oak, but attains very large diameter; reaches age of more than 500 years.

**Reproductive Power.**—Comes into full bearing at about 50 years; full seed every two or three years; reproductive power from stool very great even at 100 years old.

Grafted trees in full bearing at 20 to 25 years.

**Sylvicultural System.**—Does well with beech and oak as high forest, and requires under-planting grown pure or mixed as coppice.

C. 808-11.

APPENDIX II

Schlich.

N. Italy.  
Asturina.  
Asturina.  
Catalonia.

Italy.

Schlich.

Catalonia.

Schlich.

Catalonia.

Schlich.

Schlich.

Catalonia.

Schlich.

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vulgaris.****The Spanish Chestnut.****APPENDIX I.**

High forest generally treated under rotation of 100 years, coppice 3 to 30 (see also above under *Utility*, page 10).

Sabbah.

**Formation of Wood.**—Direct sowing is done, but chiefly planting. Nuts retain germinating power for about six months. Sow in spring as autumn sowings are eaten by mice; not too early as seedlings are tender against late frosts. Cover with about  $1\frac{1}{2}$  inches of soil; germination in five or six weeks.

Catalonia.

Trees for fruit should be young, healthy and well-rooted, transplanted generally from sites of natural production. If such not obtainable, sow in loose ground without manure. Sow while still tender not more than a month after fall.

Mr E. Buck.

[My experience in India favours the sowing of fruit as soon as possible after being gathered—in boxes protected from the climate, charcoal dust and sand being mixed with light garden soil. But the forest officers have now gained further experience and will no doubt develop a safe system of sowing.]

Sabbah.

**Nurseries.**—Sowings in drills, or nuts placed flush in rows and covered with  $1\frac{1}{2}$  inches of soil. Seedlings pricked out when a year old and put out after two years more; frequently older plants used pricked out a second time stand pruning well both on crowns and roots. Young chestnuts must be protected against early and late frosts.

Catalonia.

**Cultivation for Fruit.**—Slips when planted do not thrive well, and, consequently, all forests destined for the production of fruit are made up of young, healthy, and well-rooted trees, which are transplanted usually from the sites where they grow abundantly. If such trees are not easily obtainable, it is best to sow the seeds in loose ground, without manure, in a nursery, and, if possible, where they can be irrigated. The plants are kept in the nursery for four or five years, or till they are to be transplanted.

Raising  
plants from  
seed.

Plantations may be made directly also by sowing the seeds, the only drawback to doing this being the extra time required for the forest to yield any profit.

Transplant-  
ing.

Almost all the seeds when sown germinate, and, consequently, they may be sown close to each other, and, after growth, the least healthy plants separated and the best left at convenient distances from each other.

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The proper time for sowing is whilst the fruit is still tender, and when not more than a month has elapsed since their fall from the trees. In Gerona the best period for sowing is from December to January.

If they are to be sown later, it is then necessary to preserve the chestnuts in impermeable subterranean granaries ("silos") covered with sand; and when taken out of the "silo" the rotten chestnuts are to be separated from the sound ones which is effected by submerging them in water, when the decayed fruit will float.

Anyhow they should be sown closer to each other than usual, as many of them may not germinate.

The depth at which they should be sown is from four to eight inches from the surface.

Trees grown from seeds are transplanted in the usual manner, and in this district they are transplanted from November till February and at a distance of from 9 to 15 yards from each other, according to the development which it may be inferred the upper part of the tree is likely to attain, and which will be in direct ratio to the fertility of the soil.

In very fertile soils their closer proximity favours only the vertical growth of the plant at the expense of its fertility, but, in less favourable ground, as they develop less vigorously, more may be conveniently planted.

The trees can be transplanted at almost any age, as they take root easily, but their diameter should never exceed a couple of inches, in order that they may be safely grafted, if necessary.

The healthier and better developed trees are therefore selected, and all their branches cut off leaving only the stock.

Though the soil needs no preparation generally, if it has been previously utilised as a vineyard or as pasture land, the same culture is continued during four or five years till the young trees are sufficiently developed. If the soil has never before been cultivated, it is broken up and utilised during four or five years for growing wheat, or potatoes, in order to cover the cost of the plantation. Of course, the ground is in this case broken up before the trees are planted.

Neither for planting nor sowing is there any necessity for selecting special varieties of the plant, as grafting is, in this province at least,

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## APPENDIX E

Period for  
sowing.When  
necessary  
to prepare  
in silos.Transplant-  
ing.Planting in  
fertile and  
other soils.Remarks on  
tillage.



**CASTANEA  
vulgaris.****The Spanish Chestnut.****APPENDIX I.****Grafting :**

When not  
grafted  
fruit is small  
in size and  
late in  
appearing.

**Varieties.**

Small also  
fruit usually  
sweet.  
Late fruit  
most  
abundant.

Difference  
between  
varieties  
not great.

**Remarks on  
grafting.**

an almost necessary operation ; as if this is not done the fruit will not be of the required quality for its sale.

Grafting is effected as soon as the trees have taken root, or as soon as possible, for by doing so their period of yielding fruit is hastened.

There are many chestnut tree forests of great age, however, that have never been grafted, and consequently, the fruit these trees bear is of small size and late, though very abundant, and by no means inferior in its nourishing properties to the others ; but as the qualities most in demand are early chestnuts and chestnuts of large size, grafting with the varieties which possess these two properties is at present the prevailing custom.

When these conditions are not specially required, grafting is, perhaps, unnecessary. There appear to be from 12 to 15 varieties of chestnut trees, but it is not known, with any degree of certainty, how many of these varieties flourish within the limits of the province of Gerona. The fruit of all these varieties is pretty much the same, and they are specially distinguishable from each other only through the difference in the period in which their fruit is matured, and also by the difference in their size. Only two other observations are worthy of statement. That the small fruit is generally sweeter than that of a larger size, and that the chestnut trees which yield late fruit, yield them nevertheless very abundantly.

This excess of production is, however, of little avail to the owners in the localities where chestnuts are produced ; for as they are sold by measure and not by weight, and in equal measures small chestnuts will naturally weigh more than larger ones the advantage they might obtain is more than counterbalanced. In conclusion, it may be safely asserted that there is really very little difference between all the varieties of chestnuts produced in Catalonia.

The best method of grafting is by means of twigs (canutillos). The trees from which these twigs or slips are to be cut are pruned during winter, in order that tender shoots may be obtained from them in the ensuing summer. These twigs should have only one bud. The best period for grafting is from July to August. The stock which is to be grafted is to be cut to the height of about four feet from the ground, or as short as possible, and on the upper part the slip, without any leaves to it, is to be attached. It is well to

The Spanish Chestnut.

(Sir E. C. Buck.)

**CASTANEA  
vulgaris**

state that at the time of grafting the stock which is to be grafted should not be pruned, as this tends to increase prejudicially the number of its shoots. This should be effected in the following year, when the exuberant shoots under the grafting can be easily detached with the hand.

No other attention or care is requisite for the cultivation of these trees than what has been stated, for when the grafted slips are thriving even pruning is unnecessary. The ground under these trees is kept perfectly free from all other vegetation excepting fine grass naturally, and the soil requires neither manure nor culture of any sort whatever.

APPENDIX I

Grafted trees require little attention.

APPENDIX II.

*Methods of Preparing Chestnuts for Food.*

Fruit should be allowed to drop from the trees not beaten down.

APPENDIX II.

Gathering.

*Marrons* are always consumed fresh. Other qualities (the larger portion of yield) are ground into flour after having been dried by exposure to a slow wood fire for 30 to 40 days. The operation is carried out in small buildings constructed of rough stones (*metati*), page 18 (Tuscany).

Drying and grinding into flour.

*Preparation of Fruit for Grinding.*—To remove the husks before grinding, the most general system in Tuscany appears to be to place a certain quantity of chestnuts, while still hot, in a long sack, the ends of which are held by two men standing across a heavy block of wood, on which the sack with its contents is violently beaten. In some districts (as in the Casentina) the chestnuts are heaped in tubs and trodden under foot by men wearing wooden clogs (*zoccoli*), the soles of which are fitted with iron spikes, or, as in the Pistoia mountains, pounded with poles fitted with a serrated iron head. The final cleansing of the chestnuts, an operation termed "sventolatura" is performed by the women. While this operation is going on, the young men often dance and sing round the "metati."

Preparation for grinding.

Sventolatura or cleansing.

*Farina dolce or Chestnut Flour.*—The chestnut flour is termed "farina dolce," or sweet, in contradistinction to wheat or maize flour, but, it is rarely used as a sole article of diet, except by the poorest peasants in the mountains who are unable to obtain any other kind of food.

Chestnut flour (*farina dolce*).

**CASTANEA  
vulgaris.****The Spanish Chestnut.****APPENDIX II.****Manner of  
cooking.****Genl. p. 27.****Dried  
Chestnuts.****Form part  
of common  
food of the  
peasantry.****Chestnut  
porridge,  
cakes, bread.**

**Modes in which Chestnuts are Cooked.**—The flour, with the addition only of water and occasionally a little salt, is cooked in various simple ways, as "polenta," a thick porridge, "farinata," a soup of less consistency than the "polenta" or "necci," thin round cakes baked, between two flat hot stones, and to which a special aroma is given by placing a dried chestnut leaf above and below the paste while baking. If the above formed the sole article of diet, it is estimated that a daily ration of one kilogram of flour, converted into about  $1\frac{1}{2}$  kilograms\* of "polenta" or  $1\frac{1}{2}$  kilograms of "necci," might suffice for an adult male. These are, however, usually alternated with "polenta," made of Indian corn, or wheat and rye bread, in which case the amount of chestnut flour consumed is reduced to one-third or one-fourth, according to circumstances. The subsidiary articles of food, more or less in use, are cheese, "ricotta," stockfish, pickled herrings and sardines, sausages, beans, potatoes, and, on high occasions only, unless the peasant is in easy circumstances, pork. Other meat is not often consumed. The usual condiments are oil and lard. But little wine is drunk in the mountain districts; only occasionally, in seasons of hard work, a glass of spirits. The spring water is, however, excellent and abundant. In the less elevated zone the peasant reserves for his own use the "vinello" after the wine has been made.

Dried chestnuts are cooked in water or milk and are eaten as a soup at the evening meal (page 20, Piedmont).

Form part of the daily dietary of the peasantry peeled, cooked, and eaten with skim milk. Also often dried, placed on a frame under the kitchen chimneys when they acquire a sweet savour and are easily husked by pressure with the fingers. In this state sometimes eaten in soup instead of beans mixed with turnips. Indian corn meal flavoured with butter and bacon not ground but placed whole in soup (page 20, Venetia, Udine).

Used for porridge and cakes, and in some parts bread made from chestnuts is common among the peasants and even the better classes. During two months after crop is gathered consumption is estimated at about 4lb per head, the chestnut forming the exclusive article of food among the peasantry. In some localities it lasts four months (page 23, Asturias).

\* The kilogram = 2.2 lbs. Av.—Ed.

## The Spanish Chestnut.

(Sir E. C. Buxton.)

CASTANEA  
vulgaris.

**Mode of Cooking and Curing.**—When treating of the mode of cooking, the difference between the freshly gathered nuts and the dried and cured must be borne in mind. The latter are gathered and dried in airy storehouses, or on the open hearth before the fire in the peasant's hut, under which operation they shrink up, loose their outer skin, and become extraordinarily hard and yellow.

**Pilongas.**—They are then called "*Pilongas*," and formerly were pounded into flour and mixed with a species of mild maize or millet, for bread making but the importation and cultivation of maize proper have now replaced this mode of nutriment. Fresh nuts do not require any oily substance for cooking, simply peeled and boiled with a little salt, they make a very nutritious dish, and in soups, stews, or with beans, they are a good and agreeable substitute for potatoes. They are also roasted in their skins as a dessert.

**Different Dishes made with Pilongas.**—The nuts cured and stored called "*Pilongas*" boiled in water with a little salt, and eaten with milk, the usual Lent dish in Asturias, form an acceptable meal even to people accustomed to good living. Eaten alone in milk or mixed with honey they also make a capital plate, and taste like "*Marrons glacés*" used here in winter. In some places the nuts when dried are ground into flour, and made into a kind of porridge like the Italian polenta (page 25).

Professor Church's analysis of Chestnut Flour is the following :—

*Analysis of Chestnut Flour.*

Moisture . . . . .	14.0
Oil or fat . . . . .	2.0
Proteids . . . . .	8.5
Starch . . . . .	29.2
Dextrin and soluble starch . . . . .	22.9
Sugar . . . . .	17.5
Cellulose, etc. . . . .	3.3
Ash . . . . .	2.6
	<hr/>
	100.0

"The cakes were found to contain only 6.2 per cent. of proteids, with 3.4 per cent. of ash. The large amount of dextrin is due to the high temperature to which the chestnuts are subjected in the process of drying."

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G. I. C. P. O.—No. 48 R. &amp; A.—6-7-98.—2,225—G. R.

APPENDIX B.

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Conf., p. 26.



All communications regarding THE AGRICULTURAL LEDGER should be addressed to the Editor, Dr. George Watt, Reporter on Economic Products to the Government of India, Calcutta.

The objects of this publication (as already stated) are to gradually develop and perfect our knowledge of Indian Agricultural and Economic questions. Contributions or corrections and additions will therefore be most welcome.

In order to preserve a necessary relation to the various Departments of Government, contributions will be classified and numbered under certain series. Thus, for example, papers on Veterinary subjects will be registered under the Veterinary Series; those on Forestry, in the Forest Series. Papers of more direct Agricultural or Industrial interest will be grouped according as the products dealt with belong to the Vegetable or Animal Kingdom. In a like manner, contributions on Mineral and Metallic subjects will be registered under the Mineral Series.

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This sheet and the title-page may be removed when the subject-matter is filed in its proper place, according to the letter and number shown at the bottom of each page.

## NOTICE.

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Future issues of this publication placed under either the "Special Veterinary" or "Special Forest Series" will not be included in the annual enumeration. Such papers are printed for Departmental purposes. Their unfortunate inclusion in the system of annual numbering has led recipients of the ordinary issues to think their sets incomplete.

The following pamphlets have already appeared as Special issues, and have not accordingly been furnished to the public.

1894	.	.	.	Nos. 8, 9, 10, 11, 13 and 15.
1896	.	.	.	No. 8.

